

Self-consistent 3D Modeling of Electron Cloud Dynamics and Beam Response

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We present recent advances in the modeling of beam-electron-cloud dynamics, including surface effects such as secondary electron emission, gas desorption, etc, and volumetric effects such as ionization of residual gas and charge-exchange reactions. Simulations for the HCX facility with the code WARP/POSINST will be described and their validity demonstrated by benchmarks against measurements. The code models a wide range of physical processes and uses a number of novel techniques, including a large-timestep electron mover that smoothly interpolates between direct orbit calculation and guiding-center drift equations, and a new computational technique, based on a Lorentz transformation to a moving frame, that allows the cost of a fully 3D simulation to be reduced to that of a quasi-static approximation.